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ORIGINAL MEMOIRS.

SURGICAL INTERVENTION IN TUBERCULOSIS OF THE MENINGES AND OF THE BRAIN.[1]

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How frequently the meninges and the brain are affected by tuberculous lesions is too well-known to detain us. It is in childhood that the greatest number of cases occur. It is almost always a question of secondary tuberculous localisation, and often the final phase of a glandular, visceral or osseous tuberculosis which at a given moment breaks out in the miliary form.

For our purpose it is important to keep in mind that the greater number of cases also present anatomo-pathologically diffuse lesions, in form of exudations or multiple nodi, such as the eruption of tubercles upon the meninges and along the vessels, and that generally as their seat they prefer the base,—now the base alone, now together with the convexity in greater or less extent,—and sometimes also the spinal meninges; this signifying that in the greater number of cases, the intervention of the surgeon is impossible.

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[1] Read at the International Congress of Tuberculosis in Paris, October, 1905.

However, we know also a limited form of tuberculosis of the meninges and of the brain; tuberculous gumma, tuberculous conglomeration. Oftenest it at the same time affects the meninges and the cortex, and sometimes is isolated in the depth of the brain substance. This form of tuberculosis is in its clinical aspect quite different.

All this is well known; it suffices to mention it. What is also well established is that the frequency of occurrence of the two forms is very different. And the proportions change, according as we consider children or adults. I think it is useless to repeat here figures that can easily be obtained from the numerous statistics published.

We have then to distinguish in their anatomo-pathological and clinical aspects, tuberculous meningitis, and the solitary tubercle of the brain.

It is true that between the two forms a distinction in the true sense does not exist, and we can pass from one to the other by numerous intermediary degrees. It is equally true that the two forms are often united, and we find one or several masses of tubercles at the same time with a more or less diffuse lesion of the meninges, a classic meningitis contemporary or consecutive.

In any case the two varieties are very distinct in their typical forms and the possibility and the results of surgical intervention must be considered separately, according as we treat of the one or of the other.

Of Intervention in tuberculous Meningitis. I have already said that in tuberculous meningitis in general, surgical intervention is considered almost impossible. However, I do not think the following considerations will be without their value:

(*a*) Tuberculous meningites do not all present themselves under the form of miliary eruption, they are not all equally diffuse, nor in the same region of the brain.

(*b*) Although of very rare occurrence, a spontaneous healing of the process is nowadays considered possible.

That being so, will Surgery never be able to lend assistance?

(*a*) As to the first point, numerous researches tend nowadays to compel our admission that lesions of the meninges are sometimes limited, and present a course that has not the usual forms. I will only mention the well known essay of Chantemesse[1] in which he clearly established the special form of tuberculous meningitis *en plaque*, with quite special anatomical and clinical characters: it consists most frequently of confluent grey granulations, of yellowish pseudo-membranes or fibrous scleroses. The seat may be limited to the convexity of the brain and often to the region of the psychomotor centres.

Chantemesse distinguishes primary and secondary forms. Madeleine[2] justly remarks that we can, at most, speak of meningites which are clinically primitive without being anatomically so in every case.

See also the cases reported by Combe[3] and by Monnier.[4]

Trevelyan,[5] in 114 cases of tuberculosis of the nervous system, observed during a course of twenty years at the "Leeds General Infirmary" reports nine of this class in which there were observed thickenings localised over a limited extent of the cortex (Meningitis en plaque).

It must be observed that he clearly distinguishes these last cases from those with tuberculous masses (solitary tubercles) in the brain, of which he reports 33 in 114 cases, as we shall see later on.

A similar case calls for consideration, namely, that of Tuffier,[6] who operated a phthisical patient, aged twenty-nine years, suffering also from spasms and paralysis, and affirms that it was not a matter of solitary tubercle, but a plaque of tuberculous meningo-encephalitis. Sænger[7] reports also three cases of tuberculous lesions localized in the meninges, of which one in the left sylvian fissure in a woman of thirty-two years, another in both sylvians, in a man of fifty-eight, the third in the left sylvian in a man of fifty-two. Corresponding with the locality of the lesions there were focal clinical symptoms; in the first case, aphasia and right hemiplegia; in the third case right hemiplegia. It is to be observed that these were adults. We see from this that there exist cases, although rare, of lesions of the meninges of the ordinary type, but limited.

In the statistics given by Weingärtner[8] of 245 cases in the anatomo-pathological institute of Kiel there was not one that exhibited circumscription in the convexity. Leitz,[9] on the other hand, reports 3 cases of it in 67 (adults).

In this connection I wish to give four years' statistics from autopsies made at the school of Pathological Anatomy of the University of Rome. I owe them to the kindness of Professor Marchiafava, the Director, and his assistants, Doctors Nazari and Ugolini, who have been so good as to furnish me with them.

In about 1200 autopsies there have been in all 57 cases of tuberculosis of the meninges and of the brain.

As to Age.—Fourteen cases were children below five, fifteen between five and ten years, eleven between ten and fifteen, nine between fifteen and twenty, and eight above twenty years.

In this respect these data do not show much difference from statistics already known.

As to the anatomical form it was always meningitis more or less diffuse. In one case only (a man of thirty-seven years) there were solitary cortical tubercles in the left hemisphere.

Of the 56 cases, in 54 the meningitis had its seat at the base, and in these 54, ten had also reached the vault and oftenest in limited points as follows: above the right parietal lobe, at the foot of the first and second frontals, along the pararolandic, once with extensive softening of the left cerebral hemisphere (paracentral circonvolutions and parietal lobe).

Finally twice the tuberculous lesion was limited to the convexity of the brain, more particularly, once especially to the right half, and the other time especially on the paracentrals.

I do not intend to dwell on this point, nor to draw conclusions from a small number of cases.

I have given the above data, because in a question of such difficulty every contribution is interesting, and because I intend to weigh all the possibilities in order with more confidence absolutely or partially to reject surgical intervention.

(*b*) The healing of tuberculous meningitis is to-day considered possible, and medical literature reports some cases of it. With respect to this, Trevelyan justly remarks that we must make a distinction between the ordinary diffuse meningitis and meningitis circumscribed en plaque.

It is certain that compared with the enormous quantity of cases followed by death those cured would represent a small proportion: however there have been some. Even if we consider doubtful those adduced by Politzer,[10] by Rillett,[11] and perhaps even those by Barth,[12] Cadet Gassicourt,[13] and Carrington,[14] in which all the same a healing of the lesion was anatomically demonstrated—that also reported by Dujardin Beaumetz[15] in which tubercles were discovered in the choroid—and those by Cufer,[16] Chappet,[17] and Ward,[18] in which the diagnosis was based upon the presence of tuberculous lesions in other parts of the organism,—still there are other cases that do not admit of doubt. Thus the case reported by Freyhan,[19] in which bacilli were discovered at the lumbar puncture, and in which none the less the patient was cured and survived five years in constant good health without further symptoms. Jannsen's[20] patient died, three years after, of pulmonary tuberculosis, and the autopsy showed along the longitudinal fissure a soft yellowish mass consisting of round nodi of detritus, and in different parts of the pia mater of grey perivascular nodi. Henkel's[21] patient (bacilli in the spinal liquid) was still well after a year. Mermann[22] also reports a case of typical tuberculous meningitis, which seemed cured and the subject well for four months; then there was a return of the symptoms and death after ten days; on the examination after death typical tuberculous meningitis was proved.

If, as the author believes, this last case proves that there is always a tendency to relapse, or rather to a recrudescence of the process, and that consequently we have only an apparent cure, it loses nothing of its values as evidence.

Besides in all surgical tuberculoses and especially in osseous and articular tuberculosis, we have cures we call clinical or apparent, which are none the less true cures properly so called and may even become complete in the true anatomopathological sense of the word.

Let us consider also the later cases of Rocaz[23] (the diagnosis was based on the seroreaction of Arloing Courmont) reported and anatomically demonstrated by Cruchet,[24] those of K. Barth,[25] with discovery of bacilli; of Gross,[26] equally with positive discovery of bacilli resisting acids and of the morphological type of Koch; of Thomalla,[26] with tubercles in the choroid, of Sepet,[27] (seroreaction); of Winkler and Gohl,[28] with positive discovery of bacilli; of Mottard, [29] anatomically confirmed.

An important case has lately been communicated by Avanzino [30] of the Pammatone hospital at Genoa: the diagnosis of tuberculosis was based upon lesions of the optic papilla, on the leucocyte proportion of the liquid obtained from the lumbar puncture, and on the positive result of inoculation in guinea pigs.

See also the case I myself have operated and which I report below. Sepet[31] supports the opinion of Poncet, that is to say that we can have, fairly often, benign forms of tuberculous meningitis capable of cure and he distinguishes four anatomical varieties of it, among which he includes a light curable form of tuberculous meningitis, whose healing is due to attenuation of the virulence of the bacilli, or to increased resistance of the organism. We may add that to this last case probably belong a large number of limited or partial meningitis. See also with regard to this, the articles of Mollard and André,[32] of Dor,[33] of Bondet,[34] and Parrenin's [35] essay.

Maragliano[36] also admits the possibility of cure in some cases and he believes, that for this purpose, it may be useful to prevent, if one can, the mechanical effects of exudation. "Surgery alone," he says, "can answer this necessity in serious cases of richly fibrinous and stratified exudations."

To obtain decompression, besides the lumbar puncture, punctures have been tried of the lateral ventricles, of the fourth ventricle and its reservoir; in the well known case brought forward by Hord,[37] as there was coma and marked phenomena of compression, in the third week the fourth ventricle was punctured, and the patient recovered. But was it really a case of tuberculosis?

I think it would be useless to repeat here the various remarks published relative to similar punctures and decompressive evacuations, and besides it would take too long.

I will only mention the following fact: Concetti,[39] having ascertained the uselessness of the lumbar puncture from the therapeutic point of view, tried to use it with the object of introducing directly into the cavity of the meninges certain medicines believed to be effective against the tuberculous process. After having drawn away from ten to twenty cubic centimeters of cerebro spinal liquid, without in any way displacing his needle, he injected by means of it into the arachnoid cavity from 5 to 8 cubic centimetres of iodoformed oil of almonds at 1 per cent., or from 5 to 10 grammes of an aqueous iodo iodurate solution (1-10-100). But without result, and he abandoned the practice.

I wish to mention also the attempts made by Prof. Rotgans,[40] "Experimentally it seems possible to irrigate the base of the brain. Injecting a warm solution of colored gelatine at any point of the subdural cavity of the cranium, above the tent of the cerebellum, one finds the gelatine over the whole extent of the arachnoid, as well at the base as at the surface of both hemispheres." Guided by this Professor Rotgans, in two cases of tuberculous meningitis, injected an iodoformed emulsion into the subdural cavity. It is true he found in his autopsies, the iodoform at the base, but the children, operated when already in coma, succumbed one or two days after the operation, which was without result.

Very interesting also is a case reported by Winkler and Rotgans[41] which I will summarize here:

> "A little girl of eleven years, with chronic otitis; tuberculous bacilli were proved present in the pus. She was trepanned above the postero superior part of the temporal lobe for a left lateral epilepsy, starting from the angle of the mouth. Leaving the dura mater intact they drew out from a depth of about one centimetre a considerable quantity of seropurulent liquid, and injected in its place an equal quantity of iodoformed emulsion. Some weeks later and two or three times afterwards they repeated the same treatment through the skin at the level of the crown of the trepan. At first the result seemed favorable and the Jacksonian attacks ceased; but a year later she was in the psychiatric clinic, mad, with all four limbs contracted and amaurotic through papillary atrophy. She died completely mad in November 1899. At the autopsy they found tuberculous meningitis of the base with very acute internal hydrocephalia.

Intraventricular injection is therefore possible and even with an immediate amelioration.

Of the same kind are the experimental labors of Nannotti[42] in the treatment of meningites. After having provoked several forms of meningitis in dogs he tried treating them with subdural injections of sublimate. And he obtained excellent results in the forms of tuberculous meningitis, while in the forms of acute suppurative meningitis he had none at all. He concludes therefore that tuberculous meningitis (at least that which is obtained by experiment in dogs) is susceptible of cure by his method; that the cure may be obtained even if the treatment takes place in the most advanced stages of the disease; that the process of cure of tuberculosis of the meninges has many points of contact with that of peritoneal tuberculosis, studied both by the author himself and by others.

After these results, he proposes to apply the treatment of subdural injections of sublimate to man.

However, as far as I know, the application has not been yet tried.

Taking into account the essential difference of tuberculous lesions obtained experimentally and of the resistance of the dog, these results have still a considerable value.

Chipault[43] recalls cases of tuberculosis of the vault of the cranium, complicated by meningo-encephalic lesions, of which the typical form is the perforating tuberculosis with hour-glass collection in two parts, the one extra, the other intracranial: and reporting certain cases of it, he mentions having observed some himself. The case observed by Guarneri seems to have resembled this type.

Chipault[44] reports also a very interesting case of primitive tuberculosis of the diploé, with perforation of the internal and cortical phenomena; it seems however that lesions of the meninges were wanting. It is very seldom we have had more active interventions, and they have always been negative in their results. Attempts of this nature have been reported by Romme.[45] Chipault quotes a case from Masbrenier[46] in which through erroneous diagnosis, intervention was made above the vault. Trevelyan quotes other interventions practised with the same object by Lannelongue and Keen,[47] by Ord and Waterhouse,[48] by Parkin,[49] Paget,[50] Kendal Franks,[51] and others; he reports one equally doubtful of Mayo Robson[52] at the Leeds Infirmary.

TUBERCLES OF THE CEREBRUM OPERATED.

	OPERATOR	YEAR OF PUBLICATION	AGE AND SEX	SEAT AND VOLUME OF TUBERCLE	RESULTS	
					IMMEDIATE	LATER
1	MacEwen (?)	1885	Male, 36 years.... (Duret erroneously notes female 7 years).	Plaques of meningitis and encephalitis circumscribed (tuberculous?) on the ascending frontal (a small nut).	Cure	Continued 8 months later.
2	Horsley	1887	Male, 22..........	Tubercle of the third middle inferior of the ascending convolutions (ball of the thumb) 2 mm.	Cure	Six years after, vertebral tuberculosis; 18 months after, epydidymitis and tuberculous nephritis. Dead.
3	MacEwen	1888	Female, 7......... (Duret—Male, 37)	Subcortical tubercle in the upper part of the ascending convolutions (little nut).	Cure	
4	Knapp and Bradford	1889	Male, 32..........	Subcortical tubercle in the posterior portion, middle third of the Rolandic region (weight, 35¾ grams).	Death after ¾ hr.	
5	Mercanton and Combe	1889	Female, 12........	Solitary tubercle in the middle part of the ascending frontal convolution.	Cure	Death 4 or 5 months after the operation. At the autopsy, 4 tubercles were found at different points of the cerebrum and cerebellum.
6	Booth and Curtis	1893	Male, 35..........	Hour-glass tubercle in the frontal region (weight, 20–25 grams).	Cure	Death within two months, from relapse. Multiple.
7	Winkler and Guldenarm (?)	1893	Male, 19..........	Calcified tumor on the anterior central (healed tumor?) 2½ cm.—1½ cm. Weight, 12 grams.	Cure	Sudden death 2½ years after.
8	Czerny	1894	Male, 23..........	Tubercle of frontal region. As large as a fist (weight, 205 grams).	Cure	Re-operated for tuberculous meningitis, and died 4 years after.
9	Schwartz	1894	Male, 33..........	Tubercle of Rolandic region (centre of superior member). As large as a nut. 6×2 cm.		Death from tuberculous meningo-encephalitis 1½ months later.
10	Krönlein......	1895	Male, 43..........	Tuberculome in the inferior part of Rolandic region. As large as a hen's egg.	Cure	Still living and in fairly good health in 1901.
11	Tassi.	1895	Female..........	Tubercle in the frontal region (hazel nut).	Cure	
12	Broca	1896	Male, 35..........	Tubercle in the middle third of the ascending frontal and foot of the second frontal; partial removal with the spoon.	Amelioration	Death some months after.
13	De Paoli......	1897	Female, 18........	Tuberculome of the right motor zone.	Nil.......	Death at the end of 5 months.
14	Sick..........	1897	Female, 24........	Solitary tubercle like a hazel nut, behind the central posterior circonvolutions.	Cure	
15	Schnitzler.....	1898		Tuberculome of the right precentral circonvolution.	Died after 26 hours	

TUBERCLES OF THE CEREBRUM OPERATED—(Continued).

	OPERATORS	YEAR OF PUBLICATION	AGE AND SEX	SEAT AND VOLUME OF TUBERCLE	RESULTS	
					IMMEDIATE	LATER
16	Heidenhain[1] ..	1889	Male, 29..........	Solitary tubercle, subcortical, of the paracentral lobule (size of a small hazel nut).	Cure	Continuing 2 years after.
17	Roux	1900	Female, 7½	Tuberculome of the Rolandic region (size of a mandarin orange). 4.5×5 cm.	Cure	Continuing 2 years, 10 months after.
18	Roux	1900	Male, 38..........	Tuberculome of the Rolandic region—ascending parietal (size, pigeon's egg).	Cure	Lasting 5 months after.
19	Lunz.........	1903	Female, 22	Tubercle of the Rolandic region (size of a nut).	Cure	
20	Durante......	1903	Male, 23..........	Tubercle of the third superior of the ascending parietal and of the anterior portion of the upper and lower parietal circonvolutions.	Cure	Death at the end of three months. At the autopsy, multiple tubercles found in the right parietal and occipital lobes, in the sinus of the callous bodies, and in the great falx of the cerebrum: tuberculous leptomeningitis.
21	Tuffier	1903	Male, 29.........	Plaque of tubercular méningo-encephalitis in the left Rolandic region.	Cure	
22	Alessandri....	1904	Male, 31..........	Tuberculome of the Rolandic region—third superior (size of a small nut). 5×2½ cm.	Cure	Continuing (July, 1905).

TUBERCLES OF THE CEREBELLUM OPERATED.

	OPERATORS	YEAR OF PUBLICATION	AGE AND SEX	SEAT AND VOLUME OF TUBERCLE	RESULTS	
					IMMEDIATE	LATER
1	Bennet	1887	Male, 7...........	Tubercle of the right hemisphere (pigeon's egg).	Death	From shock after 4 hours.
2	Horsley	1887	Male, 18..........	Tubercle of right hemisphere (weight, 7 grams).	Death	19 hours after.
3	MacEwen	1893	Male.	Two tubercles of the cerebellum (one the size of a nut, the other smaller).	Cure	Died 10 months after, through relapse.
4	Parry	1893	Male, 5½.........	Tuberculome in left hemisphere. Incomplete removal with spoon.	Death	From hemorrhage or shock some hours after.
5	Lampiasi	1895	Male, 45..........	Tubercle of the left hemisphere (size of a chestnut).	Death	Of shock at the end of 15 hours.
6	Collins and Brewer	1897	Male, 26..........	Tuberculome of right hemisphere (diameter about 2 cm.). Removal in 3 fragments by spoon.	Cure	Died 2½ months after.

Published by Bayerthal, Mun. Med. Woch., 1899, No. 46. Afterward communicated by Heidenhain himself to the German Congress, 1901.

In Italy I only find five cases of interventions in tuberculous meningitis registered. They are those of Raffa,[53] of Guarneri,[54] of Codrilla[55] and two of Caselli.[56] In these two last there was a mere supposition of tuberculous meningitis, but on operating nothing was found. Those of Raffa and Guarneri are published in the report read by Roncali before the Twelfth Congress of the Italian Society of Surgery (1897), the others are reported in the collection of Chipault. In the case of Caselli the operation did not confirm the diagnosis; the case of Guarneri may be classed with those of cranial lesions with diffusion to the contents. The result was negative in all these cases.

I have myself[57] lately operated a child whose lesions led me to believe there had been a tuberculous meningitis, limited and healed.

The child was an orphan of eleven years. All hereditary syphilis was excluded; the mother died of chest complaint. There is a sister affected with ordinary epilepsy.

He had always been well until three years ago, when he began to suffer from convulsive attacks of clonicotonic type; these attacks begin in the muscles of the left hand, spread then through the whole arm, the face and the leg on the same side. It is impossible to give precise data as to the beginning of the affection; it commenced, it seems with fever and general cerebral symptoms; it is certain that all at once the attacks became more frequent, and after some time again more rare. While he was at the hospital they were repeated at irregular intervals of a few days, of a month, and even more, generally two or more attacks in the same day, the duration was always of a few minutes, without loss of consciousness; no emission of fecal matters, nor of urine; the patient did not foam, nor bite his tongue. The attack always commenced in the upper left member, spread sometimes to the face, at others to the leg, but always on the left side. It is to be noted that the attacks are generally preceded and followed by an increase of temperature (even to 38° degrees) which ceases by lysis. The objective examination presents nothing abnormal; only the muscular force of the right arm gives 25, that of the left 14. Otherwise, nothing as to mobility nor sensibility nor of the organs of the specific senses.

Operated by craniectomy; on the middle part of the right rolandic zone we found the dura mater thickened and resisting irregularly for an extension of about four by five centimetres; adhesions partly light, partly fibrous, to the soft meninges and cortical substance, especially visible along the vessels, and echelonned in nodular form in the two paracentral circonvolutions (middle part). We detached the adhesions, putting iodoform gauze in the wound on account of the fairly considerable hemorrhage, with partial suture of the dura mater, and replacing of the flap.

Healing per primam with quite normal course. On the eleventh day, a very slight attack, lasting a minute and limited to the arm and left side of face. After that, condition normal.

Although there is no diagnostic certainty, the age, the anamnesis, the lesions found on operating and above all the disposition of the adhesions along the vessels make me think that probably they were the results of tuberculous meningitis spontaneously cured.

In conclusion of what concerns the first part of my report, we must agree that, in the greater number of tuberculous processes of the meninges, above all in cases that run their course with the usual forms, surgical intervention is not to be advised, and the few cases in which it has been tried have not had success.

The different operations with decompressive scope have for the most part only a temporary value. The simple lumbar puncture has been up to now the operation preferred, on account also of its high diagnostic value. In some rare forms of meningitis in plaques, of meningitis of chronic course with localisations prevalent upon the meningian vault, or in the consequences of a localised and healed tuberculosis of the meninges we can speak of active surgical intervention. Those cases, besides, may, up to a certain point be classed among the lesions I am going to describe in the second part of my report.

Although we cannot repose with too much confidence upon the results of intervention in such cases, we must not either reject it a priori; the progress obtained in the domain of surgery exists to prove to us that, very often, successes have been obtained which theoretically seemed impossible.

Of Surgical intervention in the solitary tubercle of the brain.—When the tuberculous lesion does not take the ordinary form of a more or less diffuse meningo-encephalitis, we have what is called "solitary tubercle" whose form is generally almost spheroidal. This lesion is almost called Tuberculous Gumma, or tuberculous conglomerate, and its clinical physiognomy causes it to be classed among cerebral tumors.

Generally this type of tuberculous lesion does not affect the dura-meninge; on the contrary it attacks the pia mater at the same time as the cerebral substance in which it is embedded. It is not rare either to find it quite subcortical, without any relation with the meninges from which it is entirely removed (oval centre).

From statistics the frequency with which we find solitary tubercles in the brain is very great, above all in children. But, age apart, two other conditions are of the highest importance for the subject in hand: the part of the brain which is the seat of the tubercle and the unity or multiplicity of this last. With regard to frequency in general the statistics furnished by Allen Starr,[58] quoted in all treatises, gives out of 600 cases of cerebral tumors examined on the anatomical table, 193 solitary tubercle while the sarcomæ and gliomæ, though they are the neoplasms of most frequent occurrence are respectively only 120 and 91. The statistics of Birsch Hirschfeld[59] give 132 tubercles in 342 tumors, those of Hale White[60] 45 in 100. Durante[61] combining the statistical data of Starr, Seydel, Bernhardt, White and Birsch-Hirschfeld, in a total of 1633 cases of endocranial tumors, gives 489 tuberculosis to 414 sarcomata, 253 gliomata, and a smaller number of other less frequent varieties.

With regard to age, in 125 cases of tuberculosis in children, Simmonds[62] gives 16 solitary tubercles (12.8 per cent.), Schwer[63] 21 in 96 (21.9 per cent.); Boltz[64] 18 in 161 (11 per cent.); altogether 55 solitary tubercles in 382 cases of tuberculosis (14.4 per cent. and 2.1 per cent. for all autopsies). Hamann[65] at the Anatomo Pathological Institute of Kiel, found, in five years, among adults, 15 cases of solitary tubercles, equivalent to only 4.3 per cent. of the cases of tuberculosis. Plambeck,[66] in ten years, found still less, 9 cases

(1.8 per cent.); altogether among adults, in fifteen years, the cases of solitary tubercles represent only 3.1 per cent. of the cases of tuberculosis, and 0.7 per cent of the total autopsies.

So, among children, the frequency would be about four times greater than among adults. According to Starr, of 193 cases collected by him 152 referred to individuals below twenty years and 41 cases only to adults.

The report as to other tumors also has its importance. While among individuals below twenty years we have 37 gliomata and 34 sarcomata; above twenty years in comparison with only 41 tubercles, we have 54 gliomata, 86 sarcomata and 25 gliosarcomata. With regard to tuberculosis of the meninges, in 161 cases Boltz found it 64 times against 18 cases of solitary tubercle; Schwer observed 83 meningites and 21 solitary tubercles. In the 490 cases of Plambeck, 62 times, that is to say in 12.6 per cent. there was tuberculosis of the meninges, while the solitary tubercle only represented 1.8 per cent. Hamann, in 346 cases, found 15 solitary tubercles (4.3 per cent.) and 37 tuberculous meningites (10.7 per cent.).

But a still more important fact is that the tuberculous meningitis coexists often with the tubercle. In Boltz's 18 cases, 15 showed also tuberculous meningitis. Nothnagel[67] also remarks that the association of a solitary tubercle and of a tuberculous meningitis is a very frequent fact: in 16 cases of solitary tubercles, Simmonds found tuberculous meningitis in association with it ten times. In Eulenberg's[68] statistics, in 148 cases, 38 times there was coexistence of meningitis. Trevelyan[69] reports 33 cases of solitary tubercle in 114; and of these 33 there were 23 with meningitis.

In consequence, we may say, that, especially in children, in about 73 per cent. of the cases the solitary tubercle is associated with the tuberculous meningitis that is to say three or four times oftener than it is found isolated.

With respect to the regions of the brain attacked, Allen Starr's statistics give the greatest frequency in the cerebral axis (70), above all in the pons, in the ganglia of the base, in the quadrigeminal tubercles and in the peduncles, after that in the cerebellum (55) while in the cerebral cortex and in the oval centre they give only 22 and 8 respectively. The figures in Eulenberg's Encyclopedia give 66 cases in the cerebral axis (especially in the pons, in corpora striata, and the optic layers) 55 in the cerebellum, and 51 in the cortex. A second set of statistics gives in 108 cases of solitary tubercle, 36 in the cerebellum, 34 in the cerebral axis and 7 in the cortex. Nothnagel and Gerhardt[70] also give the cerebellum as the seat preferred, in Trevelyan's cases the order of frequency is the cerebellum, the pons, the peduncles, and then the cortex. Another very important fact for us is the frequency with which, despite its name, the solitary tubercle is multiple. In Allen Starr's statistics which we have already quoted many times, multiple tuberculomes are noted 34 times in 152 cases under twenty years, and 4 times (in 41 cases) in adults. In Eulenberg's statistics in 148 cases, 67 are really solitary tubercles, while 81 cases were multiple. In the 33 cases reported by Trevelyan 17 were multiple. In general we find 2, 3, sometimes 4; but there are other cases in which we meet with many more. Homen,[71] West,[72] Hensch[73] mention 12, Middleton[74] found as many as 24, whose size varied from that of a pea to that of a hazel nut, and which were scattered in the grey substance of the frontal, parietal and occipital lobes and in the cerebellum, and it is to be noted that there were no symptoms during life.

From all that precedes certain points have been determined, which are of capital importance for the subject of surgical intervention.

The most frequent occurrence is in children; compared with other varieties it is the tubercle that is in their case the commonest cerebral tumor. It is also in the child that we most frequently meet the multiple tubercle, very frequently accompanied by more or less diffuse meningitis.

In adults, on the contrary, it is relatively rarer and, besides, very often single and without complications.

Further in children, as in adults, the seat of the tubercles, simple or not, is often in difficultly accessible regions of the brain.

Apart from what precedes we have to consider also the two other following facts:

(*a*) The coexistence in the organism of other tuberculous lesions whose presence counterindicates any intervention.

(*b*) The possibility of a spontaneous healing without surgical aid.

(*a*) As to the first point it is well known that the ordinary tuberculoses of the meninges are nearly always secondary to other foci in the organism. We find oftenest tuberculous lesions, whether old or recent, in the glands, above all the peribronchial and mesenteric, in the lungs, sometimes in other viscera, in the bones, the joints, etc.

One may also have a diffusion of the tuberculous process through continuity (caries of the bones of the cranium, lesions of the nasopharynx, of the middle ear, etc.). According to Heller,[75] one can never have, especially in children, a direct infection through the lymphatic vessels by the nasal cavities (primitive cases?). In 44 observations on solitary tubercles, Hale White reports that there have always been other localisations of tuberculosis in the organism; only in 5 cases, was a single organ attacked and in 4 two were attacked; in the other cases, 3, 4, 5 organs or apparatuses were affected, and even more sometimes. In Trevelyan's 114 cases, only six showed no other foci; but the autopsies were incomplete.

Evidently in the case of generalised tuberculosis or of very diffuse and advanced tuberculous lesion—even of a single apparatus (respiratory, digestive, etc), it is vain to think of surgical intervention for the cerebral lesion, which, in such cases, passes into the second line. Of the 9 cases, out of Hale White's 45, cited above, that had limited foci in the other parts of the organism 1 case had multiple tubercle; in another the seat of the tuberculome was the pons. Of the other 7, one was accompanied by meningitis of the base, 3 were very diffuse.

We must recognize that these statistics are very discouraging.

(*b*) The possibility of healing of solitary tubercles is nowadays strengthened by many observations, and many researches have been made as to the manner in which this healing is effected.

The tuberculous conglomerate, really a mass of miliary tubercles, can, on developing, attain a size varying generally between that of a green pea and that of a pigeon's egg. Some even larger have been reported. Jackson says he found one as large as a billiard ball in the cerebellum of a child of five years; Arnot found four as large as a hen's egg in the cerebrum of a child of four years and a half; Nothnagel, as large as a duck's egg, Trevelyan as large as an orange and even larger. The one Czerny extirpated weighed 205 grammes, that ot Knapp and Bradford 63, that of Krönlein was as large as a fowl's egg, those of Roux and Terrier as large as mandarin oranges. Durante mentions two in the same individual, of which one weighed 30 grammes, the other 40; the one I extirpated myself was as large as a little nut.

The cheesy degeneration, above all in the centre, is ordinarily very early and its limitation by cerebral substance is also more or less definite; we often find all round a certain extension of hyperæmia and vascular development or a zone of tissue of granulations which can be sometimes transformed into a real capsule of compact fibrous tissue. In this case it is evident there is a tendency to incapsulation and sometimes to calcification which leads to a cure.

Treyer[76] reminds us that Wernicke, Gowers, Knapp, Starr, Baginsky, Sternberg, Sahli and others report cures of this class; and the greater part took place after treatment with strong doses of potassium iodide. Bruns equally affirms, that Gowers obtained cures with potassium iodide, codliver oil, iron, country air, etc.

Certainly, in such cases cure is notwithstanding always relative, and we must before all things exclude a syphilitic lesion.

In two cases he reports, Trevelyan found a fibrous centre and a calcareous mass that one might consider as healed tubercles. In one case Williamson[77] met with a little yellowish mass; in another, Ashby[78] found a little cyst with earthy walls; Bristowe,[79] in a third case, a hard mass in the cerebellum. In all three cases there was death from tuberculosis and afterwards other tuberculous masses were found in the brain. In a case reported by Kahlmeyer[80] there was a scar with yellowish striæ in the cerebellum of a woman who eleven years before, had presented phenomena of disease of cerebellum; the woman was consumptive; there was no syphilis. Oppenheim[81] reports the case of Siemon, in which the autopsy discovered in the brain an old tubercle, at first caseified, and afterwards ossified. When alive, the individual was hemiplegic and an idiot. Winkler[82] presents a case operated by Guldenarm, in which he found in the central circonvolutions, where he extirpated it, a calcified tumor of strange form, like a segment of a sphere whose chord would be 3½ centimetres. Its weight was twelve grammes and a membrane prolonging itself across the cortex put it in communication with the pia mater. After having decalcified it they found it enveloped by two membranes one thick and of connective tissue, the other of granulation tissue. These two membranes covered a centre formed of calcified detritus. The case mentioned by Foa[83] is also very important. He found in the cerebellum a nodus of fibrous, almost tendinous aspect, with irregular edges; in the centre two little yellowish foci, thick, of cheesy appearance: there were also lesions of the dura mater and of the soft meninges, demonstrating an old meningitis cured.

From what precedes we can then consider some cases as certain; others on the contrary are very doubtful and we can hardly speak of true cure; without considering that for the brain and especially for certain regions of this last, as we shall see further on, the tubercles even if they become incapsulated or are calcified always represent a lesion with grave functional symptoms. The mode of healing is rather a question of pathological histology, and although interesting, to be shorter, I shall speak of it in passing. I will mention, however, the interesting experimental researches of Barbacci[84]: He, in the struggle against bacilli, attaches the greatest importance to the fixed elements but especially to the mobile elements, first the polynucleated, then the mononucleated and to the calcification of the focus. Let me notice also the observations of Roncali[85] on the case operated upon by Durante. These observations support the possibility of a connective fibrous transformation. This commences, it seems, in the central part of the nodus, particularly under the action of the elements of immigration around tubercles which are evidently in course of involution.

In one case which I myself operated, I remarked rather a tendency to capsulation of the process by development of a connective fibrillous tissue at the periphery of the tumor, this tissue was, at certain points of adult fibrous type; this connective neoformation was not uniformly developed at all points; in the inferior section of the tuberculome, it was not clearly limited by the cerebral substance, one even saw histologically the gradual passage of the typical tuberculous granulation into the nervous tissue, accompanied by abundant parvicellular infiltration.

The results I have attempted to put together up to now lead us to the following conclusion: there can be a question of surgical intervention in only a small number of cases even when it is a matter of limited tuberculous lesions of the brain.

And this by reason of, specially, the ordinary site of the tubercles, the frequent complication with meningitis, their multiplicity, the presence of other serious tuberculous lesions in other organs of the body.

Relative to intervention the possibility of spontaneous healing has an importance which varies according to the point of view under which we consider it. In effect, if in some inaccessible regions and in case of multiplicity of tubercles, the possibility of healing has to be thought of for medical treatment, surgical intervention can not be excluded for the regions where it is possible, since a tuberculous conglomerate may occasion very serious functional derangements even if this conglomerate is capsulated and stationary. More, it may encourage to surgical action even in the possible hypothesis of other similar cerebral foci, in other silent seats.

In any case to allow of intervention the essential point is that we can diagnose with precision the seat of the lesion, and it goes without saying that this must be surgically accessible.

What precedes concerns as much the tubercle as any other cerebral tumor, and the question being well known and very common it need not delay us in our special report. Several authors have related cases of tubercles of the pons, of the quadrigeminal corpora, of the cerebral peduncles, in which symptomatology allowed the seat of the lesion to be determined, but in which there was evidently no possibility of surgical action.

It is evident that in this connection possibility of establishing exactly the seat of the lesion will present itself first to the Rolandic region; secondly and in a few cases for the tubercles of the cerebellum, for the frontal lobes, sometimes for the occipital and sphenotemporal (visual and auditory centres). It is often even much more difficult to determine if the lesion is meningeal, cortical or deep seated. For the psychomotor centres themselves the presence or the absence of epileptiform attacks accompanied, or not, by persistent pareses and their clonic or tonic character are not sufficient to allow us to diagnose the seat of the process in the meninges or in the cortex. So also in the case of cephalalgia and local heat mentioned by some. Cranial percussion both in its timbre and in the pain it causes is without gainsaying very important; MacEwen and Bruns insist on this. De Paoli[87] has made important researches with regard to this subject. Durante has proved its value in many cases; but it is not always certain. In my case, for example, the percussion and the pain led to the probable diagnosis of a lesion of the meninges while the dura mater was perfectly normal, not adherent, and the cortical focus rather deep.

When we have established the seat of an organic lesion and this seat is accessible with regard to our subject we could here put two questions:

1.—Is it possible also to diagnose the nature?

2.—And if we diagnose tuberculous tumor would that dissuade us from intervention?

In general diagnosis of nature is always very difficult.

In the particular case of tuberculosis, apart from the age, the hereditary antecedents, and the general constitution of the subject (data always uncertain) an important argument is from the presence of other tuberculous foci in the organism: most often in the lungs, in the lymphatic ganglia, in the bones or articulations.

Several consider the examination of the ocular cavity (tubercles in the choroid) as decisive: now since the positive discovery has for its special characteristic a meningitic diffusion, it is evident on this account that this discovery cannot have place in the typical cases of solitary tubercule, which are just the cases susceptible of surgical operation and one cannot have the discovery of a simple papilla of stasis (especially in circumscribed lesions) or, if it exists, it indicates nothing except an endocranial compression, whose nature it does not inform us of.

Increases of temperature at sunset, above all if coincident with the attacks, may on the contrary give us a probability. It goes without saying that we should not be able to attribute them to other causes or to other foci existing in the organism.

The same thing may be said of the injection of tuberculin; it may indeed indicate to us tuberculosis in the organism, but the lesion may exist in other organs. See the communication of Dupont[88] to the International Congress of 1900.

The diagnosis of the nature cannot be made then, or it will be rested upon probability in a few cases.

That, however, does not exclude intervention. And before everything for the good reason that even if it were demonstrated that in presence of tubercles it is better not to intervene, the uncertainty of the diagnosis should not stop us in other processes in which, given the clear symptom, intervention may be useful.

In the second place because while taking into account all the difficulties and the data mentioned above, the majority admit to-day that the tubercle is susceptible of extirpation and of cure. And statistics confirm this.

Bergmann[89] himself who is considered opposed to intervention, says merely that he does not wish to enter into the question of operation or non-intervention in the case of tubercles, especially of those of the cerebellum, but adds when the operation shows there is a tuberculous tumor it must always be removed. Now as it is generally so (the diagnosis of nature being only possible approximatively), we can say we are all agreed upon the practical indication of intervention in cerebral tubercles, provided it is indicated by the following conditions: precise diagnosis of the seat, accessible region, absence of signs of multiple or diffuse lesions, general satisfactory condition of the subject.

It is not my part here to enter into technical details which do not differ from those in the case of cerebral tumors generally.

Oftenest, the tuberculome can be removed easily thanks to the sufficiently exact limitation one finds in the greatest number of cases: we have often succeeded in extirpating them with a blunt instrument, or with the finger; seldom with the sharp knife or the spoon.

I will rather report the statistic data important for our purpose, since they teach us what has been done up to date, as well as the results obtained; they may also encourage us to greater boldness and to better hopes.

In the statistics I only include cases in which the tubercle was found on operation and removed.

The first sets of statistics of Chipault [00] and Bergmann [01] report respectively 9 cases, the first, and 8, the second, for the cerebrum and 3 and 4 for the cerebellum.

Auvray [02] adds another case.

Treyer [03] when repeating them summarized the cases already published and added two new ones from Roux.

So, altogether, deducting the operations unsuccessful or palliative, he has put together 16 cases of operations upon solitary tubercles in the brain (12 in the cerebrum and 4 in the cerebellum).

In one case however (obs. xi of Macewen) it is very doubtful if it was tuberculosis. He reports, besides, 10 cases where the intervention was ineffectual whilst the autopsy showed one or even several tubercles whose position varied. Amongst these last, one of the cerebellum (Parry's case) must be included in the first series because the tubercle was partially removed.

There were then 12 cases operated for the cerebrum, and 5 for the cerebellum. Krönlein [04] at the Thirtieth Congress of the German Surgical Society (April 1901) reporting on the man operated by him in 1895 who was still living, repeated Treyer's statistics.

Duret [05] reports 16 cases of the brain but, amongst them, he includes the case of Andrenoud, in which nothing was found at the operation.

Of the other 15, 12 were already reported in the preceding statistics; the three new ones are the cases of Bayerthal, of Lunz and Heidenhain. But Bayerthal's case and Heidenhain's are the same, the case was operated by Heidenhain and published by Bayerthal, his assistant; afterwards Heidenhain himself communicated it to the German Congress of Surgery.

There are then really 14 cases.

On the other hand, he omits the two cases reported by Sick[96] and Schnitzler,[97] which make 16 cases.

For the cerebellum he reports 7, of which 3 are already included in Treyer's statistics, and that of Parry, reported by Treyer erroneously among the unfruitful operations; but we must subtract Terrier's case, reported even by Treyer, and the other two of Jaboulay and Descot, and of Okynzic-Tuffier, in which the tuberculous tumor was not found in the operation. On the contrary I think the case of Tuffier I reported in the first part of the report can be included in the statistics.

To resume there have been 17 cases of the cerebrum and 4 of the cerebellum. To these we must add the case of Collins and Brewer, reported by Treyer.

Further we may report the Italian statistics. In Italy 6 interventions for tubercles of the cerebrum and 3 for the cerebellum have been published. The cerebral interventions are those of Tassi,[98] Poli,[99] De Paoli,[100] Bendandi,[101] Durante[102] and Alessandri,[103] those of the cerebellum are those of Lampiasi[104-105] and Nota.[106]

I résumé here the results:—In operating, the tuberculous lesion was not found either in the case of Poli (it was in the left cerebral peduncle), nor in the case of Bendandi, (two tubercles at the external and posterior part of the third temporal of both sides). Amongst the cerebellous tubercles, the first case of Lampiasi is that which Treyer and others report very inaccurately; the tumor was not discovered at the operation. In the second case, on the contrary, the tumor was found and extirpated. In Nota's case the operation was also unfruitful.

We must then only add to the statistics above given 4 cases of cerebral tuberculosis and 1 of tuberculosis of the cerebellum. In all, 22 cases of operation for the cerebrum and 6 for the cerebellum. In his last collection Chipault [107] mentions two other cases in which he only made some quite simple decompressive trepannings without finding the tumor which was discovered at the autopsy, in one of the cases they found a tubercle in each of the hemispheres of the cerebellum, and in the other they discovered a large plaque of cheesy meningitis in the right frontal region. It is also necessary to mention in passing, without including it in our statistics, the case of Fison and Luckham,[108] that is to say of a young man of 16, in which death took place before the end of the trepanning; at the autopsy a tubercle was found in the left lobe of the cerebellum.

I think on the contrary that it is necessary to add to the statistics the case of Winkler and Guldenarm mentioned above.

So that the cases operated, in which on operation the tuberculous lesion was discovered and removed either entirely or partially are 21 for the cerebrum and 6 for the cerebellum.

See in the tables (pp. 169 and 170) their most important details.

In conclusion, given the limitations to indication for operating I have spoken of above, the results are fairly good for the cerebrum. In 22 cases operated the result of the operation was favorable in 19; it is true we must add that, in some of these cases, the amelioration was very little or none at all. In several cases treated by surgical intervention, there was death following more or less closely, whether through multiple tubercules or through meningitic diffusion of the process. But in others the good result continued long enough and has probably lasted. We have in fact reports of the good health of the patients operated by Macewen (after eight months), by Horsley (after six years), by Czerny (during four years), by Krönlein (after six years), by Roux (after about three years, and after five months), by Alessandri (now after more than a year).

The statistics of tuberculoses of the cerebellum are, on the contrary, more discouraging: in fact, in 6 cases in which we have been able to find a lesion and to remove it by means of the operation, 4 cases were immediately followed by death and two others had only a transitory amelioration since death took place after two months and a half in the one case and after ten months in the most favorable case (Macewen). What precedes seems then to justify the idea of Bergmann who advises against intervention in cases of tuberculosis of the cerebellum.

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